U. S. FOREST SERVICE

RESEARCH NOTE LS-18

KE STATES FOREST EXPERIMENT STATION • U. S. DEPARTMENT OF AGRICULTURE

A Simple Weather Instrument Shelter for Plant Disease Investigations

A description of a simple, low-cost, weather instrument shelter that has been used in epidemiological studies of the University of Wisconsin, the University of Florida (Everglades Experiment Station), and the Lake States Forest Experiment Station is presented here in response to requests for the design and specifications of this shelter. Between 50 and 75 of the shelters are in use today, but no description has ever been published, although it has been mentioned in previous publications. [1] [2]

The advantages of this shelter are low cost, small size, light weight, ease of transport and storage, and versatility of use. Because of the shorter distance from the floor to the top of the instrument chamber, a thinner layer of air can be measured than in shelters with taller chambers. They can be made by low-cost laborers in slack seasons rather than by cabinetmakers or carpenters. The materials listed cost about $17 for one shelter. Labor costs are variable, depending on the ability of the worker and the number of shelters made. With systematic cutting, one man can build three shelters with 2 days' labor spaced over a week to allow for paint drying. Nine shelters can be built with less than 3 man-days of labor. Seven of the shelters will fit into a sedan delivery or panel truck. With removable legs in sockets, seven will fit in the trunk and back seat of a sedan. A man can carry two shelters a half mile with ease.

The shelter shown in figure 1 is the simplest form that has been used. Several modifications not shown include: inserted, removable legs so the shelter can be stored and transported more easily; longer legs to make the height of the shelter conform to that of a standard U.S. Weather Bureau shelter; and a hinged front, opening forward, so

[1] *Van Arsdel, Eugene Parr. Climatic factors affecting the distribution of white pine blister rust in Wisconsin. Ph. D. thesis, Univ. Wis., Madison. 1954.*

[2] *Van Arsdel, E. P., A. J. Riker, T. F. Kouba, V. E. Suomi, and R. A. Bryson. The climatic distribution of blister rust on white pine in Wisconsin. U.S. Forest Serv., Lake States Forest Expt. Sta., Sta. Paper 87, 34 pp. 1961.*

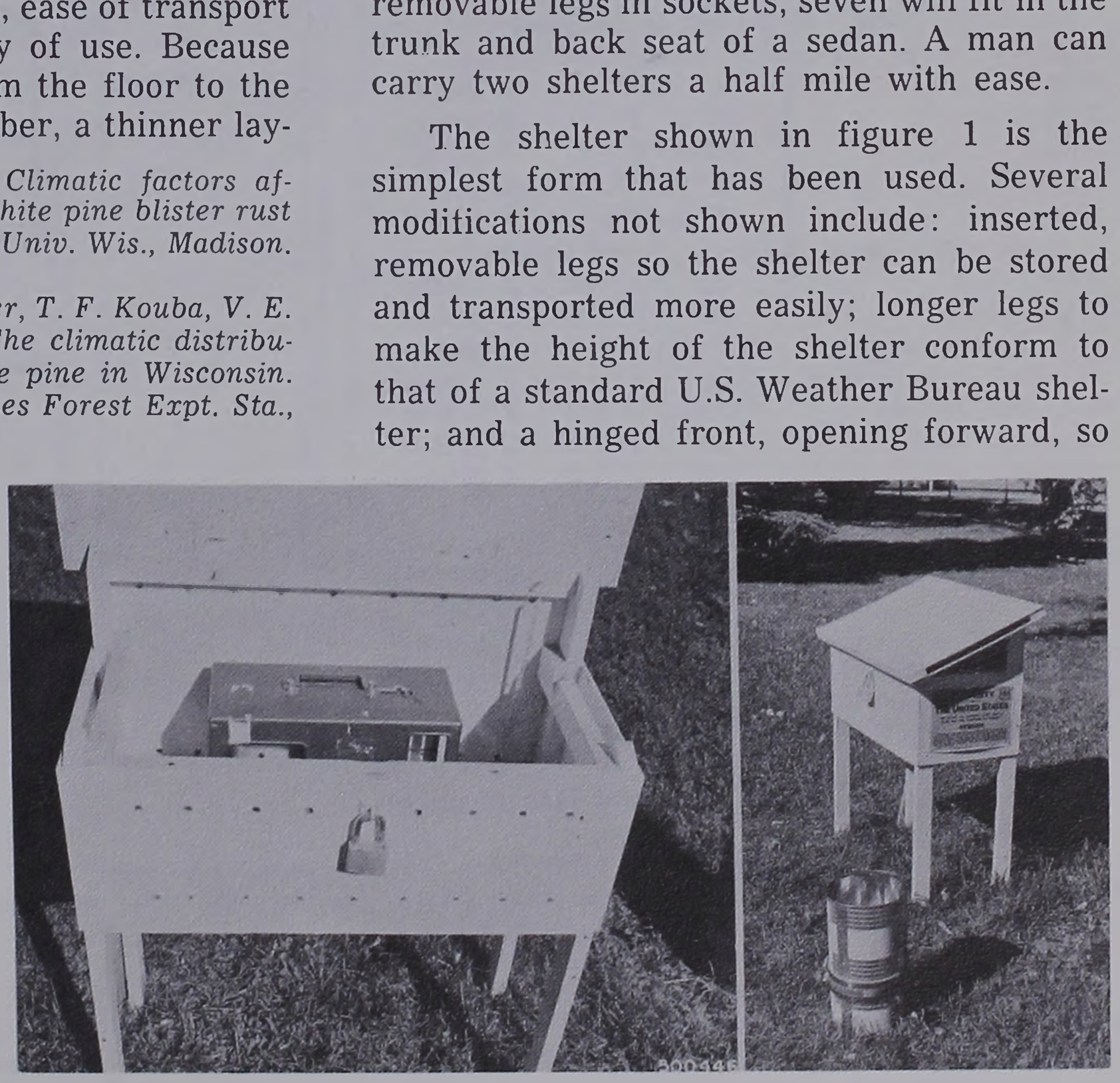

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FIGURE 1. — The instrument shelter in use.

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that instruments located at or above eye level can be read more easily. In the last form, the legs were widespread to increase stability. In another model the height of the sides, front, and back was increased to allow for the use of higher instruments; the back was 15 inches high and the front 11 inches high.

General Description

The shelter is constructed of ⅛-inch Tempered Masonite Presswood nailed to pine, cedar, or cypress 1x2-inch lumber. It has a double roof, ventilated at the ends to prevent warming in sunlight. The frame is left open at the ends, and the sides of the shelter are perforated with drilled ½-inch-diameter holes to allow free circulation of air around the instruments in the shelter.

Dimensions of the shelter are shown in figure 2. The floor stands 18 inches above the ground. Outside dimensions are 2 feet long and 1 foot wide; the back side is 13 inches high, and the front 9 inches high. The

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List of Materials for One Shelter

Tops and sides of the shelter are made of Tempered Masonite Presswood, smooth two faces. The difference in cost between the smooth one surface and the smooth two surfaces is less than the cost of the extra paint used on the rough surface.

Masonite parts (all pieces to be drawn on the Presswood prior to sawing to prevent waste):

Top	16″ x 27″	2 pieces
Ends	12″ x 9″	2 pieces
Front	24″ x 9″	1 piece
Back	13″ x 24″	1 piece
Bottom	12″ x 22½″	1 piece

Parts made from 1x2-inch planed lumber:

Front legs	28″ x 1″ x 2″	2 pieces
Back legs	31″ x 1″ x 2″	2 pieces
Longitudinal braces	22½″ x 1″ x 2″	4 pieces
Bottom end braces	10½″ x 1″ x 2″	2 pieces
Top end braces	11¼″ x 1″ x 2″	2 pieces
Roof spacers	27″ x 1″ x 2″	2 pieces
Blocks	6″ x 1″ x 2″	4 pieces

Hardware:

Hinges (brass butts)	¾″ x 2″	2 pieces
Hasp	1″ x 3″	1 piece
Hasp loop	1″ x 1½″	1 piece

½ pound sixpenny, galvanized, adhesive-coated nails (enough for 3)

1 pound ¾-inch, flathead galvanized roofing nails (enough for 3)

Screws for hinges, hasps, and hasp loop (usually provided)

For one shelter, 30 linear feet, allowing 5 feet for trimming loss (blocks are made from trim), of 1x2-inch lumber is needed. Six shelters require 180 linear feet of 1x2-inch lumber and 3 sheets of 4x8 Tempered Masonite Presswood. Five Sheets of Presswood will make 12 shelters, with 360 linear feet of 1 by 2.

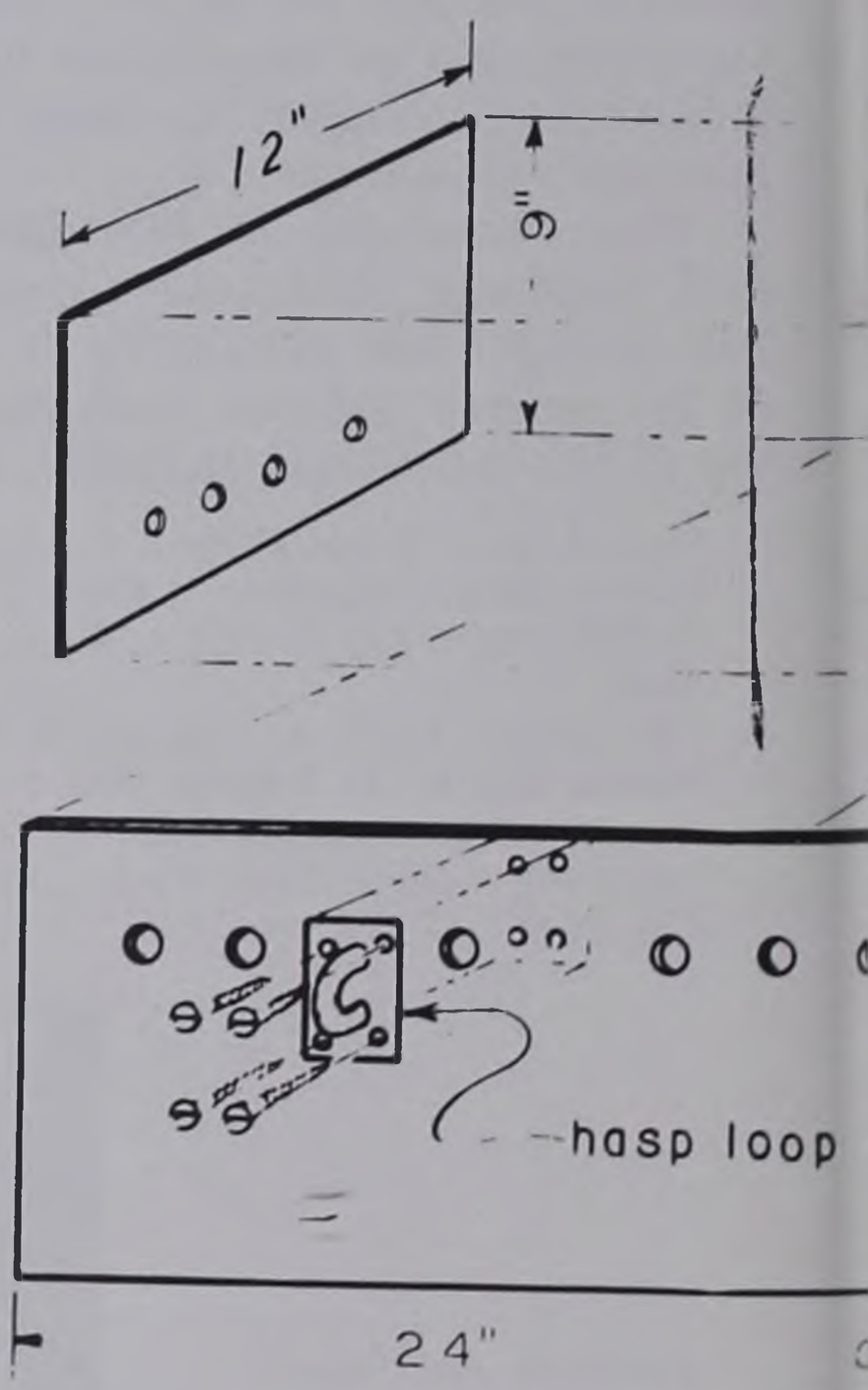
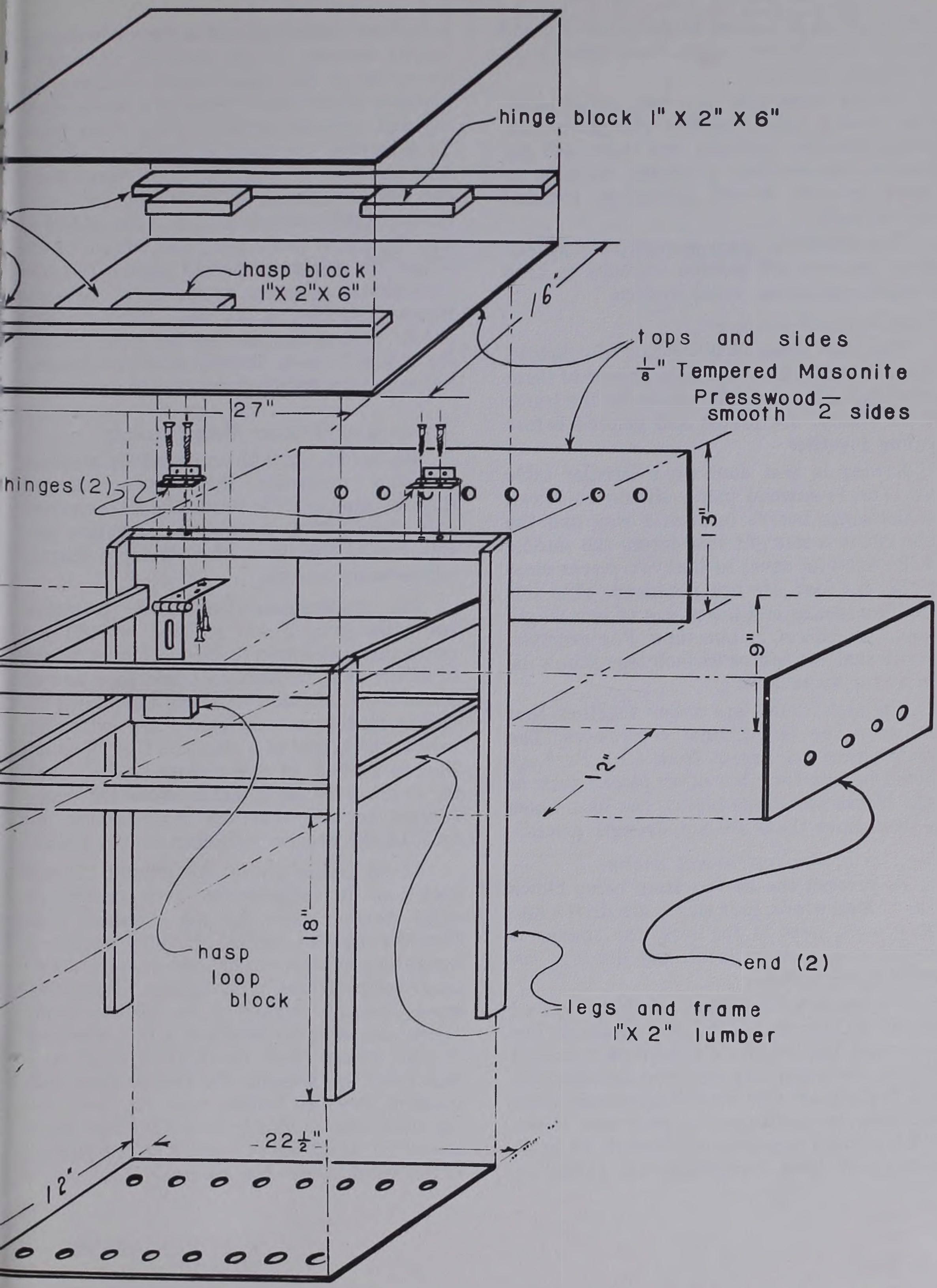


FIGURE 2. — Diagram of instrument shelter showing construction details.


hinge block 1" X 2" X 6"
hasp block 1"X 2"X 6"
16"
tops and sides
1/8" Tempered Masonite
Presswood — smooth 2 sides
27"
hinges (2)
3"
6"
12"
18"
hasp loop block
end (2)
legs and frame 1"X 2" lumber
22 1/2"
12"

roof is 16 by 27 inches. All parts are cut and painted with outside white house paint prior to nailing together.

Hinges, hasp, and hasp loop are of brass. The frame is nailed together with galvanized, adhesive-coated sixpenny box nails, and the smooth, two-surface, masonite sheeting is nailed on with ¾-inch galvanized, flathead roofing nails.

The shelter is again painted after assembling. Shelters are painted annually to keep a bright, reflective, white surface.

Construction Procedure

The most economical method of construction is to make the shelters in groups of three or multiples thereof. The pieces for the frame of the shelter are precut and painted before nailing together.

Sawing is best done on a circular table saw. The Presswood pieces should be drawn on the large boards in such a way that the first cut is a straight line across the middle of the 4x8-foot sheet so that two pieces close to the 4x4-foot size are produced. This aids handling. Brace and leg pieces of one length should all be cut at one time. For example, for six shelters twelve 31-inch legs should be cut at the same setting.

The end frames are nailed together first and then the longitudinal crosspieces. The frame pieces are precut from 1 by 2's. Legs should be knotfree; but other pieces, such as hasp blocks and hinge blocks, can have knots in them since these are not strength pieces.

The Use of the Instrument Shelter

To prevent the shelter from being blown over in high winds, four stakes are driven into the ground next to the legs, the shelter is leveled with a spirit level, and the legs are nailed to the stakes.

The location in which the shelter is placed greatly influences the results obtained. For comparing the effects of topography on local climate, the vegetative site must be standardized. A flat place with mowed grass away from any trees or buildings is a good site. If the effects of local vegetation on climate are to be studied, the same topographic site should be used, with shelters placed in the various vegetations desired. As an example, the instruments in a flat plane could compare the weather under tree crowns in a forest opening and an open meadow away from trees. To determine the range of climate of a slope, nine instruments would be used: three along the top in various or replicated vegetative covers, three similarly placed in the middle of the slope, and three along the bottom of the slope. The minimum period needed to make reasonable climatic comparisons between weather stations is 30 days. Measurements should be repeated during the same periods for at least 3 years, because wind and weather patterns vary greatly from year to year.

Accuracy of Weather Measurements

Measurements with an especially accurate platinum resistance thermometer showed that the temperature inside the boxes varied only about 0.2° C. from the temperature outside during the times of most rapid diurnal temperature change.

The standardized height of 18 inches above the ground was selected in 1951 because this was found to be a common height of blister rust cankers on white pine and of blister rust infection on ribes. Conditions favoring blister rust infections are extremely rare at the height of a standard U.S. Weather Bureau shelter. In rice disease studies, shelter floors were set 3 inches above the water surface because that was more nearly the level of the disease infections on the plants.

At 18 inches above the ground diurnal variations in temperature were greater in clear weather than for the standard U.S. Weather Bureau shelter. Nightly minimum temperatures were lower, and daytime maximum temperatures were higher. Humidities were generally higher at the 18-inch level. When placed at the height of a U.S. Weather Bureau shelter with the bottom about 4½ feet from the ground, the temperature and relative humidity results were the same on the same site. In cloudy weather, there were almost no variations as a result of differences in the height above the ground.

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